UNITED STATES PATENT AND TRADEMARK OFFICE

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EXAMINER
LI, AIMEE J

ART UNIT	PAPER NUMBER
2183	

DATE MAILED: 10/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	09/973,429	GROCHOWSKI ET AL.
	Examiner	**Art Unit**	
	Aimee J Li	2183	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _22 July 2004_.

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _29-32, 34-42 and 44-50_ is/are pending in the application.

     4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _29-32, 34-42 and 44-50_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

     a)☐ All   b)☐ Some *   c)☐ None of:

         1.☐ Certified copies of the priority documents have been received.

         2.☐ Certified copies of the priority documents have been received in Application No. _____.

         3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

     * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892) ᶜ

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   Claims 29-32, 34-42, and 44-50 considered. Claim 33 is cancelled as per Applicant's

request. Claims 29, 32, 34-35, 39, 41-42, and 45-48 have been amended as per Applicant's

request.

Objections

2.   The Listing of the Claims uses status identifiers not recognized under the Revised

Amendment Practices implemented in July 2003. For example, claims 1-28 are identified as

"Previously Canceled", but should be identified with "Canceled". Please follow the practices

outlined in the attached flyer. If these practices are not followed in the next amendment, the

examiner will be required to send a letter of non-compliance.

Claim Rejections - 35 USC § 102

3.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United
> States before the invention thereof by the applicant for patent, or on an international application by another who
> has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention
> thereof by the applicant for patent.

4.   The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999

(AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002

do not apply when the reference is a U.S. patent resulting directly or indirectly from an

international application filed before November 29, 2000. Therefore, the prior art date of the

reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA

35 U.S.C. 102(e)).

5.   Claims 39, 42, and 44 are rejected under 35 U.S.C. 102(e) as being taught by Yeh et al.,

U.S. Patent Number 5,903,750 (herein referred to as Yeh).

6.   Referring to claim 39, Yeh has taught a processor comprising:

      a.   A predicate history table to store historical information associated with a

             predicate of a predicated instruction (Yeh column 6, lines 55-59); and

      b.   A predicted predicate value (PPV) calculator to calculate a PPV for the predicated

             instruction, the PPV having a value of TRUE or FALSE (Yeh column 6, lines 55-

             59; column 7, lines 13-59; and Figure 2A).

7.   Referring to claim 42, Yeh has taught a pipeline to receive the PPV, and to conditionally

execute the predicated instruction if the PPV has a value of TRUE (Yeh column 6, lines 55-59;

column 7, lines 13-59; and Figure 2A).

8.   Referring to claim 44, Yeh has taught wherein the calculator includes a selector to, based

on a confidence level, select the PPV to be based on historical information (Yeh column 6, lines

55-59; column 7, lines 13-59; and Figure 2A).

Claim Rejections - 35 USC § 103

9.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

10.   Claims 29-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et al.,

U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Christie, U.S. Patent

Number 6,009,512 (herein referred to as Christie).

11.   Referring to claim 29, Yeh has taught A method of executing a sequence of instructions

comprising:

    a.   Determining a predicted predicate value (PPV) for a predicate of a predicated

        instruction, the PPV having a value of TRUE or FALSE (Yeh column 6, lines 55-

        59; column 7, lines 13-59; and Figure 2A)

    b.   Conditionally executing the predicated instruction if the PPV has a value of

        TRUE (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A)

    c.   Comparing the APV to the PPV (Yeh column 1, line 54 to column 2, line 17 and

        column 5, lines 8-17); and

    d.   Flushing a pipeline if the APV and the PPV are unequal (Yeh column 1, line 54 to

        column 2, line 17 and column 5, lines 8-17).

12.   Yeh has not explicitly taught executing a COMPARE instruction to determine an actual

predicate value (APV) for the predicate of the predicated instruction. However, Yeh has taught

that predication is used but not the exact details of executing predicate instructions (Yeh column

6, lines 55-59; column 7, lines 13-59; and Figure 2A). Christie has explicitly taught executing a

COMPARE instruction to determine an actual predicate value (APV) for the predicate (Christie

Abstract; column 3, lines 11-25; column 4, line 26 to column 5, line 32; column 10, lines 15-64;

Figure 6; and Figure 11). A person of ordinary skill in the art at the time the invention was made

would have recognized that through the use of predication, the wasted cycles due to conditional

branch execution would be eliminated (Christie column 3, lines 22-25). Therefore, it would have

been obvious to a person of ordinary skill in the art at the time this invention was made to

incorporate the predicate execution unit of Christie in the device of Yeh to minimize wasted cycles.

13.   Referring to claim 31, Yeh has taught wherein flushing the pipeline comprises flushing only a backend portion of the pipeline (Yeh column 1, line 54 to column 2, line 17). In regards to Yeh, flushing the instructions after the branch is the same as flushing the backend portion of the pipeline.

14.   Referring to claim 32, Yeh has taught updating historical information corresponding to the predicate of the predicated instruction in a predicate history table after comparing the APV to the PPV (Yeh column 5, lines 17-24).

15.   Referring to claim 34, Yeh has taught wherein conditionally executing the predicated instruction (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Yeh has not explicitly taught treating the predicated instruction like a no-op if the value of the PPV is FALSE. However, Yeh has taught that predication is used but not the exact details of executing predicate instructions (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Christie has explicitly taught treating the predicated instruction like a no-op if the value of the PPV is FALSE (Christie column 3, lines 15-17). A person of ordinary skill in the art at the time the invention was made would have recognized that through the use of predication, the wasted cycles due to conditional branch execution would be eliminated (Christie column 3, lines 22-25). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this invention was made to incorporate the predicate execution unit of Christie in the device of Yeh to minimize wasted cycles.

16.   Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh in view of

Christie as applied to claim 29 above, and further in view of Heuring and Jordan's <u>Computer</u>

<u>Systems Design and Architecture</u> (herein referred to as Heuring).

17.   Referring to claim 30, Yeh has taught flushing the pipeline. Heuring has taught

executing the predicated instruction after flushing the pipeline (Heuring page 228, paragraph 3).

A person of ordinary skill at the time the invention was made would have recognized that

executing the predicated instruction after flushing the pipeline is needed to ensure normal

execution of the pipeline is resumed after a misprediction has occurred. Therefore, it would have

been obvious to a person of ordinary skill in the art at the time the invention was made to

incorporate executing the predicated instruction after flushing the pipeline as taught by Heuring

in the device of Yeh in view of Christie to ensure normal execution of the pipeline after a

misprediction.

18.   Claims 35-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et al.,

U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Heuring and Jordan's

<u>Computer Systems Design and Architecture</u> (herein referred to as Heuring).

19.   Referring to claim 35, Yeh has taught a processor comprising:

    a.   A predicate history table (Yeh column 5, lines 17-24)

    b.   A predicted predicate value (PPV) calculator having a first input coupled to an

        output of the predicate history table and a second input coupled to an output of the

        register file, the PPV calculator to calculate a PPV, having a value of TRUE or

        FALSE, for a predicated instruction (Yeh column 6, lines 55-59; column 7, lines

        13-59; and Figure 2A).

20.   Yeh has not explicitly taught a register file. Heuring has taught a register file (Heuring

pages 174-175, section 4.6.2; page 200, paragraph labeled The Register File; and Figures Data

Path and Register File). A person of ordinary skill in the art at the time the invention was made

would have recognized that register files are necessary for data to be stored and retrieved from.

The register file is faster than external and main memory and easier to access later in a process,

thereby minimizing delay due to retrieving data. Therefore, it would have been obvious to a

person of ordinary skill in the art at the time the invention was made to incorporate the register

file of Heuring in the device of Yeh to store and retrieve data faster.

21.   Referring to claim 36, Yeh has taught:

    a.   A IP select circuit having an output coupled to the predicate history table (Yeh

        column 4, lines 17-24);

    b.   An instruction decoder having an output coupled to input of the IP select circuit

        and the register select circuit (Yeh column 1, lines 16-37; column 4, lines 38-48;

        column 5, lines 8-13).

22.   Yeh has not explicitly taught a register select circuit having an output coupled to the

register file. Heuring has taught a register select circuit having an output coupled to the register

file (Heuring pages 174-175, section 4.6.2; page 200, paragraph labeled The Register File; and

Figures Data Path and Register File). A person of ordinary skill in the art at the time the

invention was made would have recognized that register files are necessary for data to be stored

and retrieved from. The register file is faster than external and main memory and easier to

access later in a process, thereby minimizing delay due to retrieving data. Therefore, it would

have been obvious to a person of ordinary skill in the art at the time the invention was made to

incorporate the register file of Heuring in the device of Yeh in order to store and retrieve data faster.

23.   Referring to claim 37, Yeh has taught a pipeline having a PPV input coupled to an output (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A) and an actual predicate value (APV) output coupled to an input of the predicate history table (Yeh column 5, lines 17-24). Yeh has not explicitly taught a register file. Heuring has taught a register file (Heuring pages 174-175, section 4.6.2; page 200, paragraph labeled The Register File; and Figures Data Path and Register File). A person of ordinary skill in the art at the time the invention was made would have recognized that register files are necessary for data to be stored and retrieved from. The register file is faster than external and main memory and easier to access later in a process, thereby minimizing delay due to retrieving data. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate the register file of Heuring in the device of Yeh in order to store and retrieve data faster.

24.   Referring to claim 38, Yeh has not taught a device having a first input coupled to the APV output of the pipeline, a second input coupled to an output of the register file, and an output coupled to a flush input of the pipeline (Yeh column 6, lines 55-59; column 7, lines 13-59; and Figure 2A). Heuring has taught an XOR gate (Heuring page 72-73, paragraph labeled Data Transmission in the Computer). A person of ordinary skill in the art at the time the invention was made would have recognized that XOR gates are needed for data transmission, to selectively transmit certain signals between elements (Heuring page 72, beginning of paragraph labeled Data Transmission in the Computer). Therefore, it would have been obvious to a person of

ordinary skill in the art at the time the invention was made to incorporate the XOR gate of

Heuring in the device of Yeh in order to selectively transmit certain data signals.

25.   Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yeh et

al., U.S. Patent Number 5,903,750 (herein referred to as Yeh) in view of Natarjan et al., U.S.

Patent Number 5,857,104 (herein referred to Natarjan).

26.   Referring to claim 40, Yeh has not taught a speculative predicate register file to store the

PPV. Natarjan has taught a speculative predicate register file to store the PPV (Natarjan column

5, lines 45-51). A person of ordinary skill in the art at the time the invention was made would

have recognized that the speculative predicate value needed to be stored in order to be used in

future cycles of the instruction. Therefore, it would have been obvious to a person of ordinary

skill in the art at the time this invention was made to incorporate the speculative predicate

register file of Natarjan in the device of Yeh to store data.

27.   Referring to claim 41, Yeh has taught a pipeline to receive the PPV, and to conditionally

execute the predicated instruction if the PPV has a value of TRUE (Yeh column 6, lines 55-59;

column 7, lines 13-59; and Figure 2A).

28.   Claims 45-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Natarjan et

al., U.S. Patent Number 5,857,104 (herein referred to Natarjan) in view of Yeh et al., U.S. Patent

Number 5,903,750 (herein referred to as Yeh).

29.   Referring to claim 45, Natarjan has taught a system comprising:

        a.   Memory to store a predicated instruction (Natarjan column 4, lines 42-51 and

                Figure 4)

b.   A bus to transfer the predicated instruction from the memory (Natarjan column 4,

lines 42-51 and Figure 4).

30.   Natarjan has not taught a processor to receive the predicated instruction and to calculate a

predicted predicate value (PPV) for the predicate of the predicated instruction, the PPV having a

value of TRUE or FALSE. Yeh has taught a processor to receive the predicated instruction and

to calculate a predicted predicate value (PPV) for the predicate of the predicated instruction, the

PPV having a value of TRUE or FALSE (Yeh column 6, lines 55-59; column 7, lines 13-59; and

Figure 2A). A person of ordinary skill in the art at the time the invention was made would have

recognized that predicate prediction improves processor performance (Yeh column 2, lines 18-

20). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this

invention was made to incorporate the predicate prediction of Yeh in the device of Natarjan to

improve processor performance.

31.   Referring to claims 46, 47, and 48, Natarjan has not taught:

a.   Wherein the processor comprises a predicate history table to store historical

information associated with the predicate of the predicated instruction

(Applicant's claim 46).

b.   Wherein the processor further comprises a pipeline to receive the PPV, and to

conditionally execute the predicated instruction if the PPV has a value of TRUE

(Applicant's claim 47).

c.   Wherein the processor further comprises a pipeline to receive the PPV, and to

conditionally execute the predicated instruction if the PPV has a value of TRUE

(Applicant's claim 48).

32.   Yeh has taught:

   a.   Wherein the processor comprises a predicate history table to store historical

          information associated with the predicate of the predicated instruction

          (Applicant's claim 46) (Yeh column 6, lines 55-59).

   b.   Wherein the processor further comprises a pipeline to receive the PPV, and to

          conditionally execute the predicated instruction if the PPV has a value of TRUE

          (Applicant's claim 47) (Yeh column 6, lines 55-59; column 7, lines 13-59; and

          Figure 2A).

   c.   Wherein the processor further comprises a pipeline to receive the PPV, and to

          conditionally execute the predicated instruction if the PPV has a value of TRUE

          (Applicant's claim 48) (Yeh column 6, lines 55-59; column 7, lines 13-59; and

          Figure 2A).

33.   A person of ordinary skill in the art at the time the invention was made would have

recognized that predicate prediction improves processor performance (Yeh column 2, lines 18-

20). Therefore, it would have been obvious to a person of ordinary skill in the art at the time this

invention was made to incorporate the predicate prediction of Yeh in the device of Natarjan to

improve processor performance.

34.   Referring to claim 49, Natarjan has taught wherein the memory is main memory

(Natarjan column 4, lines 42-51; column 6, lines 1-21) and the bus is a system bus (Natarjan

column 4, lines 42-51; column 6, lines 1-21).

35.   Referring to claim 50, Natarjan has taught wherein the memory is external memory

(Natarjan column 4, lines 42-51; column 6, lines 1-21).

Response to Arguments

36.   Examiner withdraws objection to the title in favor of the amended title.

37.   Applicant's arguments filed 22 July 2004 have been fully considered but they are not

persuasive.

38.   Applicant argues, in essence, on pages 9-10

> ...Because Yeh only discloses a system that operates on branch instructions, and
>
> branch instructions are fundamentally different than predicated instructions, Yeh
>
> fails to disclose each and every element as claimed...

39.   This has not been found persuasive. Yeh has taught that in order to implement branch

prediction, there must be predicate prediction. This indicates that branch instructions are a type

of predicate instruction, since a predicate must be predicted to make a branch prediction. In

general, a predicate instruction executes a instruction based upon whether a condition is true or

false. In the case of branch instructions, a branch is taken or not taken, i.e. the program jumps or

does not jump to a target address, based upon whether the predicate condition is true or false.

Therefore, a branch instruction is a type of predicate instruction, since it executes a jump

instruction based upon whether the condition is true or false.

40.   Applicant' argues, in essence, on pages 10-14

> Furthermore, the applicants claim "a PPV for the predicated instruction, *the PPV*
>
> *having a value of TRUE or FALSE*"...Yeh describes predicting the outcome of a
>
> branch instruction, the prediction having a value of "Taken" or "Not
>
> Taken"...Since a predicate value of "TRUE" or "FALSE" is not the same as a
>
> predicated branch value of "Taken" or "Not Taken", and Yeh fails to described

predicting a value of "TRUE" or "FALSE", Yeh fails to describe each and every

element as claimed...

41.   This has not been found persuasive. "Taken" and "Not Taken" is a yes or no value, i.e. a

single bit represents this value with a 0 or 1. A value with "True" and "False" is similar in

function, i.e. a single bit represents this value with a 0 or 1. Therefore, "Taken" or "Not Taken"

and "True" or "False" are functionally similar and represent similar conditions. Also, a

conditional branch or conditional jump is determined as "Taken" or "Not Taken" based upon

whether the condition is determined to be "True" or "False", as stated in the definitions of

"conditional branch" and "conditional jump" in Microsoft's Computer Dictionary: The

Comprehensive Standard for Business, School, Library, and Home Second Edition.

Conclusion

42.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure as follows. Applicant is reminded that in amending in response to a rejection of

claims, the patentable novelty must be clearly shown in view of the state of the art disclosed by

the references cited and the objections made. Applicant must also show how the amendments

avoid such references and objections. See 37 CFR § 1.111(c).

    a.   Adler et al., U.S. Patent Number 5,627,981 and 5,923,863, has taught

       speculatively executed predicate instructions.

    b.   Klauser et al., U.S. Patent Number 6,442,679, has taught predicting predicate

       instructions.

    c.   Gschwin et al., U.S. Patent Number 6,513,109, has taught executing and
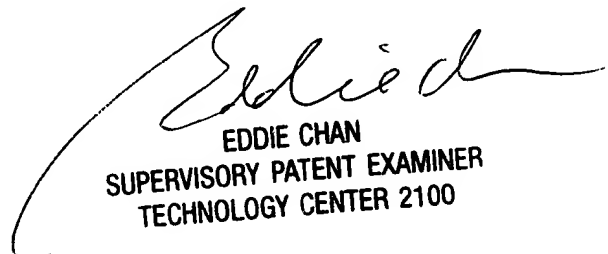
       predicting predicate instructions.

     d.   Arora et al., U.S. Patent Number 6,629,238, has taught predicting predicate instructions.

43.   Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aimee J Li whose telephone number is (571) 272-4169. The examiner can normally be reached on M-T 7:30am-5:00pm.

44.   If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Chan can be reached on (571) 272-4162. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

45.   Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AJL
Aimee J. Li
18 October 2004

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